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MACHINE TOOLS AND METALWORKING EQUIPMENT

No. 5

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USSR REPORT

Machine Tools and Metalworking Equipment

No. 5

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INDUSTRY PLANNING AND ECONOMICS

HEAVY INDUSTRY EXHORTED TO PRODUCE MORE, BETTER MACHINERY

Moscow IZVESTIYA in Russian 4 Feb 83 p 1

[Article: "Important Task of Heavy Industry"]

[Text] Laborers in heavy industry contribute significantly to organizing the production of consumer goods. It currently accounts for more than half of all the nonfood goods produced in the country. Electrical engineers, machine tool builders, construction industry workers and workers in many other branches current meet consumer needs for heaters, lamps, crystal, dishes, washing machines and vacuum cleaners. The collectives of many enterprises of defense industry are actively engaged in producing goods, having mastered a complex assortment of items, including television sets, radios, refrigerators, motorcycles, motor scooters and cameras.

Enterprises of Moscow and Sverdlovsk Oblast have done much work along this line, their initiative on increasing consumer goods production having been approved by the CPSU Central Committee. Modern, specialized production facilities producing household appliances in great demand among the populace have been created at such giants of industry as the ZIL, "Uralmash" and Novomoskovsk Turbine Plant. This five-year plan, laborers in heavy industry in Moscow will be increasing their production of cultural, household and domestic goods by nearly a third. Machinebuilders of Sverdlovsk Oblast are participating actively in implementing the target program for increasing production and improving quality. By the end of the five-year plan, the amount of goods being produced in the oblast will exceed the wage fund of workers and employees in the material production sphere.

But by no means all enterprises of the machinebuilding branches are using their opportunities in this area. Production of cultural, household and domestic goods comprises only 1-3 percent of the total amount of goods being produced in the Ministry of Power Machinebuilding, Ministry of Heavy and Transport Machinebuilding, Ministry of Ferrous Metallurgy and a number of others. The Ministry of Machinebuilding for Light and Food Industry and Household Appliances is the lead ministry for 35 items of household appliances, but fully meets the demand for practically none of them. Last year, the shortfall in deliveries of household refrigerators to consumers was 300,000. At the same time, due to the failure of the assortment to meet consumer demands, thousands of refrigerators were not sold at the interrepublic trade fair for 1983 orders. What conclusions did the branch headquarters draw? The release of unpopular models was not only not cut back, but was even increased. At the same time, the release of larger, more convenient refrigerators has been increasing slowly.

Automotive industry, the lead branch producing bicycles and motorcycles, has great opportunities. At the same time, this is the second five-year plan in a row in which assignments on developing production of these goods have not been met. As subsidiary farms and orchard-vegetable plots are developed, the demand for means of small-scale mechanization has increased sharply. However, the lead ministry, the Ministry of Tractor and Agricultural Machinebuilding, has not sensed its coordinating role in this important matter; it lags in the development and creation of new types of small cultivators. In this same branch, cultural, household and domestic goods comprise about two percent, and means of small-scale mechanization comprise only a fraction of a percent. Naturally, the problem will not be solved with an attitude like this.

The local Soviets of People's Deputies have been given broad rights in shaping consumer goods production plans and monitoring their fulfillment. It is important that they be fully used. As Comrade Yu. V. Andropov, CPSU Central Committee General Secretary, pointed out at the November (1982) CPSU Central Committee Plenum, "local party and soviet agencies must tackle in earnest the production of consumer goods.... In fact, it cannot be considered normal that questions of producing all but a number of simple goods are decided in the USSR Gosplan. It is necessary that local agencies assume this concern and be fully responsible for its resolution."

The Soviets of People's Deputies are called upon to assume supervision of the development of consumer goods production. These items are sometimes produced unsystematically, giving rise to a shortage of some items and an excess of others. The soviets do not always use the powers given them in the area of coordinating and monitoring the activity of associations, enterprises and organizations in their areas which produce consumer goods. This aspect of their activity must be strengthened. Deputy commissions are called upon to increase their demandingness of economic leaders responsible for consumer goods production.

It is no secret that the requirements of the population for a whole series of household goods are not being fully met. Enterprises of heavy industry bear a certain measure of responsibility for this as well. For example, metallurgists fail year in and year out to meet plans for the production of metal-enamel and galvanized dishes. Last year, consumers failed to receive 17 million rubles worth of such items. Moreover, metallurgists prefer to produce the more expensive decorated dishes, but do not spoil consumers with a broad range of colors. There is a scarcity of items considered labor-intensive for sale -- teapots, coffee pots, churns -- and few sets of dishes are being produced.

We have yet to overcome mistakes in planning the production of individual types of goods and studying demand. Due to this, there is sometimes a shortage of items which were quite recently readily available. We need to perfect the system of planning, stimulating and material-technical supply for facilities producing consumer goods. Material resources are generally allocated only for items in the basic products list. Meeting the demand for items needed by the populace is also being retarded by the practice of planning their release in branches of machinebuilding and heavy industry in cost terms; planning in physical units is done only for a limited assortment.

Consumer goods production is an important task for all branches of industry. Improvement in the well-being of the Soviet people and increasingly better satisfaction of their material and spiritual interests depend largely on how successfully it is resolved.

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SYSTEM FOR PLANNING IN MACHINEBUILDING ENTERPRISES

Kiev TEKHNOLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 3, Apr-Jun 82 pp 8-9

[Article by Candidate of Economic Sciences N. V. Luzhetskiy and engineer K. Ye. Fedunenko, Odessa Institute of the National Economy, NIITkriogenmash[1], Odessa: "Evaluating and Planning the Organizational-Technical Level of Machinebuilding Enterprises"]

[Text] The USSR Ministry of Chemical and Petroleum Machinebuilding has worked out a system for determining the organizational-technical level of an enterprise which permits evaluating the status and opportunities of sectors and shops, revealing shortcomings and outlining steps to eliminate them, at all stages of its retooling.

This system is used to evaluate types of production -- basic and auxiliary -- and also functions -- technical preparation of production, use of production capacities and product quality control.

The organizational-technical level is determined using the criteria developed and is evaluated on a point scale: 0.1, 0.3, 0.5, 0.7, 0.9.

The highest point, 0.9, corresponds to automated production, 0.7 -- comprehensively mechanized, 0.5, 0.3 and 0.1 -- production with correspondingly lower levels of organization and mechanization.

The proportionate influence of each criterion in an overall evaluation of the level of a type of production is determined by factors totalling one (1).

The organizational-technical level of an enterprise is calculated as follows: The organizational level of enterprise subdivisions Y_o is determined by type of production and functions. We then determine enterprise subdivision technical level Y_t by type of production and functions, as well as the overall technical-organizational level of the subdivisions $Y_{o.t.}$ by type of production and functions:

$$Y_{o.t.} = \sqrt{Y_o Y_t} .$$

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[1][Not further identified, but indicates research institute for machinebuilding relating to cryogenics.]

The number of industrial production personnel $P_{i.p.p.}$ is calculated for each function and type of production, and we then determine the organizational-technical level of the enterprise as a whole:

$$Y^{ent.}_{o.t.} = \frac{\Sigma\, Y_{o.t.}\, P_{i.p.p.}}{\Sigma\, P_{i.p.p.}}.$$

The level values obtained are compared with the normative values established for a specific type of production and a plan of steps to attain the prescribed normatives is then drawn up.

As a result of an evaluation made of the organizational-technical level of enterprises of cryogenic machinebuilding, it was established that the actual value was 60...90 percent of the normative level indicator for various enterprises. Therefore, much attention was focused on developing technology and improving production organization, as factors which significantly determine the organizational potential of enterprises, when working out the basic directions for implementing scientific and technical progress in 1981-1985.

When resolving the tasks set, primary attention was focused on the following questions:

mechanizing and automating assembly and assembly-welding processes;

mastering new, progressive processes for obtaining blanks close to finished parts in shape and expanding the area of application of ones previously mastered;

raising the organizational-technical level of auxiliary production;

developing and perfecting the organizational forms of the production process.

The basic method of raising the organizational-technical level in the cryogenic machinebuilding subbranch is the shaping of comprehensive programs for developing all the most important production facilities. Such programs ensure the necessary comprehensiveness and sequentiality of scientific research and experimental design, as well as the establishment of schedules for introducing their results. All programs are approved by subbranch orders, creating the organizational-legal basis for carrying them out.

Thus, comprehensive programs for the scientific-technical development of enterprises in the 11th Five-Year Plan anticipate a whole series of steps reflecting modern achievements of both domestic and foreign scientific and technical progress.

For example, in blank cutting production we anticipate the introduction of automated plasma and air-plasma metal cutting; in forging-stamping production -- rolled metal reduction and drawing, liquid stamping and positive-displacement seamless swaging on horizontal forge presses; in foundry production -- electroslag casting using stainless steel, pressure chill casting using meltable models; in mechanical assembly production -- laser working, diamond smoothing, industrial robots, automated chargers, cutting tools with mechanically secured plates, and others.

We plan the creation of 24 comprehensively mechanized sectors and shops and the introduction of 15 mechanized-flow, conveyor and automated lines in the subbranch. The proportion of NPC [numerical preset control] machine tools will be increased two-fold during the 11th Five-Year Plan, special and unit machine tools -- 1.5-fold, automatic and semiautomatic machine tools, precision and high-precision machine tools -- 1.3-fold.

With a view towards lowering expenditures of heavy manual labor, we anticipate raising the level of mechanization and automation to 38 percent for foundry production facilities, 70 percent for welding, and 75 percent for loading-unloading work in intraplant shipments. As a result, about 70 percent of the workers will be doing no manual labor at all.

The savings from lowering output net cost as a result of introducing measures in the comprehensive programs at enterprises of cryogenic machinebuilding will exceed five million rubles. In this regard, the availability of capital to labor calculated per worker will increase to 47 percent, the availability of power -- to 28 percent, the level of use of standard technological processes will be 24.5 percent and the equipment operation shift index will reach 1.6.

The system for evaluating enterprise organizational-technical levels thus will permit a rise in the level of enterprise development planning and accelerated introduction of the achievements of scientific-technical progress.

The basic methodological provisions of the system can be successfully applied at machinebuilding enterprises of other branches both during their retooling and when drawing up comprehensive scientific-technical development programs.

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ALL-UNION SCIENTIFIC-TECHNICAL SOCIETY MEETS ON MACHINEBUILDING

Moscow TRUD in Russian 25 Jan 82 p 2

[Article by USSR Council of Ministers Deputy Chairman A. Antonov in a "special issue devoted to the 6th All-Union Congress of Scientific-Technical Societies opening today in Moscow": "Policy: A High Technical Level"]

[Text] It is a generally recognized truth that the rates of national economic development depend in considerable measure on active use of the achievements of science and technology. "We have large reserves available to us in the national economy.. ," Yuriy Vladimirovich Andropov stressed at the November (1981) CPSU Central Committee Plenum. "These reserves must be sought out in accelerating scientific-technical progress, in introducing the achievements of science, engineering and leading experience into production quickly and extensively."

We have long had forms of ties between science and production which have successfully justified themselves. These include the experience of a number of the largest scientific-production associations. They include the active, creative interaction of a number of enterprises with the USSR Academy of Sciences. Finally, they include "going out into the branches" by the Institute of Metallurgy imeni A. A. Baykov, the Institute of Arc Welding imeni Ye. O. Paton, the Physics Institute imeni P. N. Lebedev, the Leningrad Physicotechnical Institute institutes of the Siberian Division of the USSR Academy of Sciences, and scientists of many higher educational institutions.

Members of the scientific-technical societies also actively assist the acceleration of technical progress. Today, with the opening of the 6th All-Union Congress of Scientific-Technical Societies in Moscow, we state with pride that its delegates are the best representatives of the working class and the scientific intelligentsia. Scientific-technical society activists make an important contribution to raising the technical level of products, facilitate labor productivity growth, improvement in product quality, reducing low-skilled manual labor and the creation of waste-free technologies. Their participation in carrying out the comprehensive scientific-technical programs is becoming increasingly appreciable. However, and this will naturally be discussed at the Congress, scientific-technical society members could have done far more. In this connection, I should like to touch on a number of pivotal problems where the contribution of innovators could have been more perceptible.

The technical level and quality of certain types of machinery, equipment and apparatus do not meet modern demands. Hence, the task arises of sharply improving the quality of machinebuilding output. It is machinebuilding which plays an exceptional role in accelerating scientific-technical progress. We have quite a few examples of the successful resolution of complex technical problems.

In the 10th Five-Year Plan, series production of 145 new means of mechanizing lift-transport, loading-unloading and warehousing jobs was mastered. Over the past two five-year plans, the number of metal-cutting machine tools with numerical preset control has increased 5.5-fold. Production of computer equipment has increased more than 10-fold, and of automation devices and means -- 3.3-fold.

During the past five-year plan, the level of overall mechanization of cattle farms has risen from 28 to 42 percent, hog farms -- from 58 to 63 percent, and of poultry farms -- from 59 to 72 percent.

I will not keep on listing the achievements of machinebuilders. Their successes are well-known, and this is unnecessary confirmation of how much can be done with skillful organization. And the reverse: where reserves have not been used, where management has not been skillful, plans have not been met and output of insufficiently high quality has been produced. As was justifiably noted in the resolutions of the 26th CPSU Congress and the CPSU Central Committee Plenums, there has been some lag in machinebuilding behind the requirements of the economy. It is for good reason that the changeover to a path of intensification is especially important in machinebuilding branches.

These problems did not arise today or yesterday. They were referred to at the All-Union Conference on Machinebuilding. Much is being done to correct the situation, and at the same time, much laborious work faces us in further accelerating scientific-technical progress. It is very important that the attention of scientific-technical society members be drawn to it. Skillful orientation of the creative forces of the scientific-technical community towards solving precisely these pivotal problems would doubtless provide a large impact. The publically operated institutes, laboratories, bureaus of economic analysis and technical information, and councils for scientific labor organization have been called upon to make an additional contribution to resolving the tasks of technical improvement and intensification of production.

So the problem is to increase the effectiveness of the development, production and use of machinebuilding output. But the solution to this problem is not so simple. We must not fail to take into account causes of an objective nature which make it harder to solve this task. These include the slower increment in labor resources due to consequences of the war, increasing difficulties in extracting mineral and other raw materials, as well as the growing energy demands.

But if I were asked to name the primary reserve on which the end results of the work of our machinebuilding depend, I would say without hesitation: the technical level of the equipment, machine tools and all output being produced. What did an evaluation made two years ago of the technical level of approximately 20,000 items of machinebuilding output show? About one-third of these items required modernization or withdrawal from production.

It is precisely the technical level and quality of the output which must be made the foundation of the activity of each enterprise, institute and machinebuilding as a whole. The task is this: a broad woad must be opened to highly effective equipment; the path should be barred to producing yesterday's devices and machines.

Unfortunately, we still must often encounter situations in which the periods for developing and introducing new equipment are extremely drawn out. The process of mastering the production of an industrial tractor in Cheboksary and the motor for it in Volgograd is impermissibly long. The main reason is the extremely low level of design-technological resolutions. Similar delays have occurred at ore-enrichment combines with regard to mills from the Syzran' plant, 500 mW turbine generators of the "Elektrotyazhmash" Plant imeni V. I. Lenin in Khar'kov, and a number of other types of equipment.

Today, machinebuilding not only must product highly effective equipment, but must also actively assist the consumer in using it productively. Those who forget this unavoidably get into difficult situations. An analysis of the designs of a number of domestic machines shows that proper attention is not being paid to ease and convenience of controls, to creating comfortable working conditions. There have been many comments about lowering noise and vibration in cabs, improving vision and automating controls.

And there is the spare parts problem. This is in fact also one of the aspects of the technical level of the output. It is a mistake to provide spare parts just by increasing production volumes. It is important to improve the operating reliability and service life of the equipment.

In fact, one often encounters the reverse. For example, about a tons of spare parts go to maintainint one DE-75 tractor in operating condition each year, and over the entire depreciation period -- 6-7 tons, or 30 percent more than the weight of the tractor itself.

Organizing work in machinebuilding to save material resources is a complicated, multilevel problem. The main conditions for solving it successfully are these: improved design, precise adherance to production technology and modern materials. How are these conditions being met?

Some of our tractor models are heavier than corresponding foreign models. It has been estimated that if their metals-intensiveness were lowered to optimum values, tens of thousands of tons of rolled and other metal could be saved each year.

There are quite a few opportunities for saving metal in production technology as well. For now, the bulk of our blanks are being made using backward technology and on obsolete equipment. Free forging ctill comprises only a third of our total forged blanks production volume. Stamping using meltable forms, powder metallurgy and electrical technology are being introduced slowly.

The development of new machinery, equipment and devices is always a complex of efforts by many branches of the national economy. The technical level of the developments therefore is largely determined by progressive, modern materials and assembly components. This is a necessary conditions for producing modern machinery and devices, equipment able to compete. Machinebuilders are being let down especially by enterprises of ferrous and nonferrous metallurgy, chemical and petrochemical industry.

Here, in brief, in a most compressed form, is the range of problems which need to be solved to accelerate scientific-technical progress. I have already recalled that first violin must be played here by the scientists, designers, technologists and managers. But scientific-technical society activists can also be of considerable assistance by participating in public reviews to evaluate the technical level of output and equipment, by recommending the elimination of hand operations, by ensuring the recording of all labor-intensive processes. It is known what harm is caused the national economy by delay in mastering advanced scientific developments. Scientific-technical society members can influence acceleration of the introduction process even more actively. Their task is to directly assist in the practical implementation of everything progressive, from birth of the concepts to their embodiment in new prototypes of machinery, materials and equipment, and finally, to series production. Scientific-technical society members will doubtless continue to persistently strive for a high level of scientific and engineering support to production development and will make a worthy contribution to implementing the resolutions of the 26th CPSU Congress.

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ESTONIAN QUALITY CONTROL SYSTEM FOR MACHINEBUILDING DESCRIBED

Tallinn SOVETSKAYA ESTONIYA in Russian 11 Jan 83 p 2

[Article by P. Kudinskiy, department chief of the Estonian Center for Standardization and Metrology: "Improve Economic Methods by a Single Technology"]

[Text] Further development of industry in the Estonian SSR in the 11th Five-Year Plan period must be provided mainly on the basis of intensifying production, introducing scientific-technological achievements widely and improving qualitative work indicators.

According to the basic directions of economic and social development in 1981-1985, it is planned to increase in the Estonian SSR the volume of industrial output by 14 to 17 percent with the development at an accelerated rate of the electronic, instrument building and electric equipment industries.

The 18th party congress of Estonia posed the problem of increasing the output of products of the highest category of quality to 25 percent of the total volume of commercial products by the end of the five-year plan period.

Under these conditions the problems of increasing the efficiency of production and improving the quality of products become of special importance. The solution of these problems is facilitated by the introduction of the Single System for Technological Preparation for Production (YeSTPP).

The development of the complex of mutually related YeSTPP standards was implemented in our country in accordance with the decree of the CPSU Central Committee and the USSR Council of Ministers "On raising the role of standards and improving the quality of the output products." With the creation of the YeSTPP, work on changing the technical preparation for production is more systematic and concrete. This innovation provides for a unity of terminology, classification, design and technological documentation, the organization of the norm-reference material, opens up wide possibilities for creating machine systems on the basis of standardization, the use of unit head equipment and standard fixtures. The YeSTPP introduced concreteness into the solution of the problem of raising production dynamism, the organizational-technical efficiency and the quality of work.

Many republic enterprises which introduced this system achieved a high level of use of typical technological processes, standard readjustable fixtures and standard unit-head equipment. What does this mean?

In working according to typical technological processes, typical fixtures for large groups of parts are used and there is no necessity, for example, to make so-called cams for each part machined on turret and planer automatic machine tools. This reduces time losses for machine tool adjustment and makes it possible to expand multi-machine tool servicing.

At the Tartu Monitoring Apparatus Plant, a universal rapidly readjustable turning lathe fixture is widely used. It was developed by B. Batrakhanov, a turner-innovator and winner of the state bonus. It contains rapid-action turning chucks, cutting tool cassettes, rapid action drilling and threading fixtures. Sets of such fixtures were supplied to 50 turning lathes in basic and auxiliary shops of the enterprise.Their use increased the productivity of turning labor by 25 to 30 percent.

Typical technological processes are used in casting, plating, painting and varnishing and other types of production.

The advantages of flow lines, formed on the basis of standard unit-head equipment, are high productivity and comparatively simple servicing, which is especially difficult to achieve when the line consists of machine tools of several difficult types.

The highest level of using typical technological processes -- 94 percent -- was achieved at the Electrical Equipment Plant imeni Kh. Pegel'man. Over 20 standards were developed and introduced at this plant within the framework of the technological production preparation system. The economic effect of introducing YeSTPP at the plant was about 250,000 rubles in the 10th Five-Year Plan period and was obtained by raising the level of standardization of products and the typicalization of technological processes, as well as by the introduction of new equipment in accordance with the plan and a reduction in the time taken for scientific research and experimental design work. It is only right that the Plant imeni Kh. Pegel'man have one of the leading places in the republic on producing products with the state emblem of quality.

In the Tartu Instrument Building Plant, the economic effect from introducing the YeSTPP during the 10th Five-Year Plan period was over 550,000 rubles, and almost 62 tons of ferrous metals,and 74 tons of nonferrous metals were saved.

Valuable experience in using typical technological processes, standard readjustable fixtures and equipment was accumulated at the "Dvigatel'" Plant, the Tartu Monitoring Apparatus Plant and several other enterprises.

At the same time a number of enterprises did not fulfill the YeSTPP tasks for 1976-1980. Among them are the Tallin "Prombribor" Production Association where the level of typical technological processes at the end of the five-year plan period was 15 percent for a task of 39 percent of standard readjustable fixtures -- 26 percent instead of 45 percent and standard readjustable equipment --

only one percent. It is no accident that this enterprise produces almost no products of the highest category of quality and did not achieve a high standard of production. Frequently there are violations of technological discipline here, and design and technological documentations are not of high standard.

Also the work on introducing the YeSTPP is not sufficiently organized at the Electrical Equipment Plant imeni M. I. Kalinin, the "Vol'ta" Plant and the "Talleks" Production Association.

At present there is a prepared comprehensive program to introduce and develop a YeSTPP program in the USSR in machinebuilding and instrument building in 1981-1985, a component part of which is a similar program for the Estonian SSR. The problem is that by the wide introduction of low-waste and power-saving technological processes, automatic lines, sets of high productivity equipment and modern types of tools, provide for the stability in the quality of manufactured products, an increase in the efficiency of production, higher productivity of labor, higher metal utilization coefficients in production with lower unit consumption, and a further reduction in the time and costs of preparing for production of high quality products.

A great amount of purposeful work must be done by the republic administration of the Gosstandart, specialists of the machinebuilding and instrument building enterprises, and party organs. A radical improvement is necessary in the introduction of the organizational-methodological side of the YeSTPP. While in the past five-year plan period, basically enterprise specialists were trained, now, in addition, popularization of advanced experience is needed. This should be done by the scientific-technological people, the Estonian SSR Academy of Sciences, and higher and secondary educational schools. Obviously, the time has come to form a Representative Social Council on YeSTPP at Engineer's Palace which would coordinate the activity of all enterprises and organizations on questions of technological preparation for production. It also appears expedient to create corresponding sections at technical economic councils of city and rayon party committees.

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MACHINEBUILDING PRODUCTION PLANS TO 1990 DISCUSSED

Moscow PRAVDA in Russian 7 Mar 83 p 2

[Article by N. Kostikov, general director of the Broacher and Shears Production Association imeni S. M. Kirov: "Tomorrow's Concerns"]

> [Text] Attention to Experience: Enterprise leaders are as a rule always engaged in solving numerous urgent matters and everyday problems. But it is well said that it is a poor leader who lives with the interests of one month or year and does not see prospects for enterprise development beyond the everyday cares. How to combine the both of them? In machine-tool manufacture, this is probably especially important, inasmuch as labor productivity growth in many branches of the national economy depends foremost on it.

The directorate and party organization of our association decided to draw up a long-range plan of enterprise technical, economic and social development for the 11th Five-Year Plan and the period up to 1990. What parameters must the output we produce have? What organizational, technological and social measures must be implemented for our machine tools to be able to compete in the world market? How to improve the quality and raise the technical level of the items?

A small group of leaders were incapable of working out a long-range plan by themselves. This became obvious immediately after the basic problems to be solved were formulated. The party organization requested the entire association collective to take part in working out a long-range plan.

Each person made suggestions and expressed his thoughts at the level of his own knowledge, experience and ability. This was truly a large-scale creative search for optimal resolutions of the tasks facing us. It was a bold search, but one based on real opportunities.

It was especially hard to correctly outline the basic trends in improving the equipment being released and in its development to 1990. It was even harder, based on a forecast, to formulate demands on future output, to define its specific parameters.

How can all this be expressed most fully in the plan? Our specialists had studied this problem thoroughly in advance, taking into account the achievements of machine-tool manufacturers in various countries of the world. The search was facilitated by the considerable creative experience accumulated in the collective and the branch.

Our collective began the current five-year plan with a capacious plan of action. It anticipated the development of new equipment in stages and mastering its production quickly. Under this plan, we are now mastering a range of "fourth-generation" machine tools, primarily automatic machines which correspond to the level of the world's best models. Specialists estimate that machine tools such as ours will permit freeing about 300 workers for other jobs and saving at least 200 tons of metal in a year. The overall impact of introducing plant innovations into the country's national economy will be 33.5 million rubles.

In a word, the long-range plan in a way lit our path of development and focused the attention of the collective on the most important, pivotal problems, and by that alone augmented our strength. It is not possible to reveal all the technical problems we have resolved, are resolving and will be resolving under this plan. Let me cite just a few as examples.

For the first time in world practice, we have manufactured and are operating a vertical broacher with a tool bin and an automatic manipulator for setting up and taking down parts. Shears with numerical preset control have been created. The products list of automatic continuous-operation machine tools and other special machine tools is broad.

Our entire current products list of continuous-operation broachers as a whole will enable us to free upwards of 400 workers for other work and to save more than 2,000 tons of metal on an annual basis. The economic impact exceeds a million rubles. Here, for example, is how we are dealing with the urgent demands of pipe-makers. Special machine tools for broaching turbine disk channeling will permit increasing labor productivity in this operation up to two-fold and improving the precision of the machining.

In other words, long-range association activity planning permits the most effective, comprehensive resolution of problems of technically improving our output, achieving a sharp improvement in the qualitative indicators not only of machine-tool manufacturing itself, but also in machinebuilding. For example, having automated the cutting of blanks, we are increasing labor productivity in this operation an average of two-fold, freeing 6-10 workers engaged in manual labor in each sector.

The increasing complexity of the tasks has required expansion of association ties with research institutions and the fuller use of their scientific potential. We are now cooperating with 10 institutes and planning-design organizations. We are faced with implementing more than a thousand measures prior to the end of the five-year plan; their economic impact will be about two million rubles. We will then be able to cut a fifth of the workers engaged in manual labor and solve practically all the tasks outlined for the technical improvement of production.

An important role in the long-range plans is given to enterprise renovation, to introducing industrial robots and manipulators. The reconstruction is being accompanied by improvement in work with personnel. During the first two years of the five-year plan, the shop chief and deputy shop chief staffs have already been significantly renewed through the general director and party committee reserve. Specialists who have proven themselves in practical activity, who take a long-range view and are able to find a correct approach to their subordinates, have been assigned these positions. Much importance is being attached to the forman's council, which serves as a school for educating lower-link leaders.

All this has created in the association a healthy moral climate and is inculcating a spirit of creativity and competitiveness. During the past year, overall losses of working time per 100 workers has dropped by 5.5 percent. We understand that we are obligated to achieve more and, following the example of Muscovites, are relying on the creation of an atmosphere of intolerance towards any manifestations of disorganization. We are being rendered much assistance in this by the system of steps and demands worked out to ensure defect-free labor and execution monitoring.

The social development program is aimed at increasing the interest of each worker in the successes of his own enterprise. During the past five years, about 200 of them have improved their housing. Young workers and specialists have been granted places in well-provided apartment-type dormitories and the demands for children's preschool institutions are being met. About 600 workers vacation in sanatoria and boarding houses each year. The production subdivisions have been equipped with dining halls, modern personal-services buildings, a winter garden and museum of combat and labor glory.

Benevolence, attention to requests and critical observations by people, have become the norm at the enterprise. This is also ensuring good labor discipline and a conscientious attitude on the part of workers towards their duties. The collective has successfully met the socialist obligations for the second year of the five-year plan.

So we are carrying out our own long-range plan. The resolution of everyday tasks is being subordinated to the more distant goal of creating equipment which is not only not inferior to world models, but surpasses them. However, is has been by no means easy or simple for us to achieve high indicators and take a longer step towards technical progress.

For example, renovation of the assembly shop will increase our opportunities for producing the special machine tools so necessary to industry, and subsequently automated lines as well. However, it is going more slowly than we would like, partly through our own fault, but more because of others. It has become necessary to renovate the foundry and tool shops, which will enable us to create capacities to produce special tools for machine tools and improve working conditions.

As before, the problem of material supply remains critical. Delivery schedules are constantly disrupted by such enterprises as the Makeyevka metallurgical and Kuybyshev bearing plants. In order to guarantee smooth enterprise operation and consequently that contract obligations will be met, we need to replace the quarterly delivery schedules for materials and assembly components with monthly deliveries or some other mutually agreed upon schedules. We need to increase the products list of economical metal sections, which will doubtless improve their use coefficient. It is very important, in my view, that machinebuilding enterprises be better provided with standard and standardized tools.

We have repeatedly required that our suppliers raise the technical level and improve the quality of certain types of electrical and hydraulic apparatus and preset-control systems. The competitiveness of the equipment being released now and in the future depends in significant measure on these items. However, not all of our related enterprises have responded in business-like fashion to our appeal. For example, electrical engineering items from Tbilisi and Yerevan suppliers have not improved in recent years.

In a word, we need the joint creative efforts of specialists in many branches of the national economy to achieve the common goal.

11052
CSO: 1823/56

METAL-CUTTING AND METAL-FORMING MACHINE TOOLS

PRESS FORGING MACHINEBUILDING PLANS FOR 1983

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 1, Jan 83 pp 2-5

[Article by USSR Deputy Minister of the Machine Tool and Tool Building Industry A. P. Vasil'yev: "The Tasks of Press Forging Machinebuilding in 1983"]

[Text] Our country has entered the third year of the 11th Five-Year Plan. The achievements of our people are great, the tasks facing them are enormous and complex. The inviolable unity of the party and the people and their aspiration to advance firmly and steadfastly along the Leninist path are the guarantee that these tasks will be successfully accomplished. The regular CPSU Central Committee Plenum, which was held in November 1982, and the 7th Session, 10th Convocation, of the USSR Supreme Soviet confirmed this with new force.

General Secretary of the CPSU Central Committee Comrade Yu. V. Andropov delivered a major speech at the plenum. In his speech the continuity of the domestic and foreign policy of the party is noted, a description of the plan and budget for the next year of the five-year plan is given, it contains a thorough analysis of the state of the Soviet economy, the difficulties and shortcomings in the development of the national economy are revealed, the ways and means of overcoming them are indicated.

The 26th CPSU Congress clarified the long-range strategy of the party for the period of the 11th Five-Year Plan and the 1980's as a whole--a strategy with the aim that the Soviet people from year to year would live better and that their labor would yield greater and greater results, that our socialist system would reveal more and more completely its humane essence and its creative potentials.

During the examination at the CPSU Central Committee Plenum and the session of the Supreme Soviet of the progress of the fulfillment of the state plan of USSR economic and social development in 1982 and the draft of the plan for 1983 it was noted that in 1982 the amount of national income, which was used for consumption and accumulation, came to 460 billion rubles and had increased as compared with 1981 by 2 percent. Here approximately 80 percent of the total amount of national income goes directly for ensuring the well-being of the people.

In 1982 in conformity with the agrarian policy of the CPSU the saturation of agriculture with modern tools and means of labor continued. The amount of capital investments in agriculture for the entire set of operations came to 37 billion rubles.

Measures, which are aimed at the dynamic development of industry and agriculture, the concentration of capital investments and the further development of the economy of each Soviet republic, are envisaged in the plan for 1983. The work on increasing the efficiency of the national economy will be continued--intensive assignments have to be fulfilled with a comparatively smaller increase of material expenditures and manpower resources.

Much attention is being devoted to the development of the agro-industrial complex and the fulfillment of the USSR Food Program. As a whole about 47 billion rubles will be channeled into the development of the complex--4.3 percent more than in 1982. The gross output of agriculture will come to 137.3 billion rubles and will have increased as compared with 1982 by 10.5 percent.

The party policy of increasing the well-being of the people is maintained in the plan.

The per capital real income in 1983 will increase by 3 percent as against its average annual increase during the first 2 years of the five-year plan by 1.8 percent. The public consumption funds will increase during the year by 4.7 percent and will come to 134 billion rubles.

The State Plan of USSR Economic and Social Development and the USSR State Budget for 1983 were approved by the USSR Supreme Soviet and thereby acquired the force of law.

The collectives of the enterprises and organizations of the Ministry of the Machine Tool and Tool Building Industry as a whole successfully coped with the 1982 plan, but there are a number of plants and associations which did not fulfill the plans and obligations with respect to the volumes and products list. The further improvement of the sectorial structure of production was ensured: with an increase of the production volume of machine tools by 3.2 percent as compared with 1982 the production volume of forging and pressing equipment increased by 15 percent. The share of forging and pressing equipment in the total output of metalworking equipment for the Ministry of the Machine Tool and Tool Building Industry came to 20.3 percent by number and 24 percent by volume instead of 19 and 22.7 percent in 1980.

The production of a number of new types and models of advanced equipment was developed. The production of such automated forging and pressing equipment as sets of equipment for the stamping of parts made from strip on the basis of single-action single-crank open presses with a force of 0.25, 0.4, 0.63 and 1.6 MN; a set of equipment for the stamping of parts made from sheet on the basis of a single-action single-crank open press with a force of 0.63 MN; a single-action single-crank press with a force of 1.6 MN with dial feed; a unit for the stamping of items made from piece blanks on the basis of a double-crank closed press with a force of 3.15 MN with a loading manipulator and a discharge device; a unit for the stamping of parts made from roll material on the basis of a single-action double-crank closed press with a force of 5 MN with loading and discharge devices and so on, was begun in 1982.

New type sizes of automated hydraulic presses, forging machines, shears, bending and straightening machines, as well as new automatic equipment for various purposes were assimilated in 1982.

The automated units based on hot-stamping and forging equipment, in the case of the use of which the working conditions improve considerably and labor productivity increases, should especially be singled out. Among the assimilated units are the unit, which was developed by the Voronezh Industrial Association of Forging and Pressing Equipment and is based on closed multipass forging rollers with a center distance of 500 mm with a manipulator, a unit based on a steam-air forging hammer with a maximum usable frequency (MPCh) of up to 2 tons with a manipulator with a lifting capacity of 400 kg and others.

It is necessary to note the prototype of the set of model AKPA1235-1, which was developed at the Experimental Scientific Research Institute of Press and Forging Machine Building, is based on a hydraulic forging press with a force of 3.15 MN and is designed for the forging of forged pieces like shafts, blocks, flanges, rings and other blanks weighing from 50 to 500 kg, which are made from carbon and low-alloy steels. A forging manipulator and a setting machine with a lifting capacity of 0.63 ton are included in the set. The production of forged pieces, the forging of which at present is carried out on steam-air hammers with a maximum usable frequency of 2 and 3 tons, is possible on the unit, here manual labor is reduced to a minimum or is completely eliminated.

The range of equipment for obtaining precision blanks has been enlarged by the assimilation of such machines as an automatic double-roller thread-cutting machine with a force of 0.5 MN for the rolling of rolling screws 80 mm in diameter; a hydraulic press with a force of 10 MN with an ejector and a reverse actuating cylinder; hydraulic shears for the straight cutting and the cutting of edges for welding of sheets up to 32 X 3,150 mm; a hydraulic press with a force of 40 MN with loading and discharge devices for the isothermic stamping of machine building parts; an automatic multiposition hot-stamping machine for rod-type items 27 mm in diameter; a radial reducing machine with a force of 2.5 MN with loading and discharge devices and others. New automatic presses for powder metallurgy, including a hydraulic press for the compacting of items made of metallic powders with a force of 10 MN, automatic machines for the compacting of items made of the powders of hard alloys of different forces, an automatic press machine for the sizing of cermet items with a force of 1.6 and 4.0 MN, have been assimilated.

Measures on the increase of the productivity and reliability of forging and pressing equipment and the decrease of its metal content in conformity with the approved goal programs were implemented in 1982. The further increase of the technical level and competitive ability of the equipment being produced and the increase of the proportion of the output being produced with the State Seal of Quality were ensured on this basis.

In 1982 the press builders took an active part in the implementation of the Food Program, by developing machines which promote the rapid development of agricultural machine building, the automotive and tractor industries. Equipment was delivered to tens of enterprises, which are furnishing agricultural production with new equipment, including Rostsel'mash, the Tashkent Tractor Plant imeni 50-letiya SSSR, the Altaysk Tractor Plant imeni M. I. Kalinin and other tractor plants, the Odessapochvomash Industrial Association, the Moscow Motor Vehicle Plant imeni I. A. Likhachev, the Gorkiy Motor Vehicle Plant, the Kama Motor Vehicle Plant and others.

Everything achieved in 1982 is the result of the improvement of the technology, the introduction of advanced techniques and methods of labor, including the brigade forms of its organization, the more extensive mechanization and automation of production and its further specialization. And, of course, the extensive socialist competition in honor of the 60th anniversary of the formation of the USSR for the early and high-quality fulfillment of the annual assignments and obligations was conducive to the success of the leading enterprises.

In 1982 the sector was changed over to planning and reporting in accordance with the standard net output, which makes it possible to evaluate most objectively the activity of production collectives, since it includes their own expenditures of labor on the production of output. This indicator disciplines, forces them to fulfill the assignments in accordance with the products list and to observe manning discipline. The different level of the profit, which is a part of the standard net output by groups of pressing and forging equipment, makes it possible to stimulate the production of the most advanced equipment. As a whole the changeover to the standard net output required a change of not only the method of planning, but also the methods of work.

The tasks of the sector are specified by the decisions of the November (1982) CPSU Central Committee Plenum and by the State Plan of Economic and Social Development for 1983.

In the report of Deputy Chairman of the USSR Council of Ministers and Chairman of USSR Gosplan Comrade N. K. Baybakov at the 7th Session, 10th Convocation, of the USSR Supreme Soviet it was noted: "...The increase of the quality of the machines being produced, the preferential increase of the production of highly productive and economical equipment and the decrease of the metal content of equipment will be the most important direction of the development of MACHINE BUILDING AND METALWORKING [in boldface] in 1983."

It is envisaged to increase the production volume of forging and pressing equipment by approximately 5 percent, the share of forging and pressing equipment in the total output of machine tools and forging and pressing equipment will increase to 24.2 percent by volume and 26.6 percent by number. The production of all categories of advanced equipment will increase, the share of automated forging and pressing equipment in the total output will come to 30 percent. In essence one machine in three will be produced by the enterprises of the Ministry of the Machine Tool and Tool Building Industry in automated design and the consumers of our products should take this trend of the constant improvement of the structure into account in their plans and forecasts.

The assimilation or series production of new highly productive and economical machines of a wide range of automated units and automatic lines for all the technological process stages of press forging has been outlined in accordance with the plans of the development of science and technology.

Units of various designs for the cutting of sheet measuring 4 X 2,000 mm, 6.3 X 2,000 mm and 6.3 X 3.150 mm on the basis of sheet crank shears with a slanted blade; a mechanized unit based on crank cutting tools for the cutting of blanks with a force of 16 MN with a roller table and rack; sets of equipment based on combined press-shears for sheets of different thickness with feed module-roller tables; an NC automatic unit for the punching of holes and recesses and the cutting of steel angles and others are being assimilated and produced for the cutting of sheet and rolled metal.

For sheet metal stamping in the plan there are single-crank open presses with a force of 0.16 MN with dial and slide feeds; a set of equipment for the stamping of parts made from sheet on the basis of a single-crank open press for a force of 0.63 MN; a robotized technological unit for the stamping of items made from piece blanks on a single-action single-crank open press with a force of 0.4 MN with an industrial robot with a lifting capacity of 1.25 kg; robotized sections, multi-machine technological units for the stamping of parts made from piece blanks on the basis of two single-crank open presses with a force of 0.16 and 0.25 MN with a two-armed robot with a lifting capacity of 1.25 kg; two presses with a force of 1.0 MN and a three-armed manipulator with a lifting capacity of 5 kg; an NC hole-punching revolving press with a force of 1.0 MN with the automation of the feeding of the blanks and with cutting and milling modes; a set of equipment for the stamping of parts made from roll material on the basis of a single-action single-crank closed press with a force of 4.0 MN with a straightener and feeder; sets for the stamping of parts made from roll material on the basis of a single-action double-crank closed press with a force of 8.0 MN with loading and discharge devices; single-action hydraulic sheet-stamping frame presses with a force of 1.6 and 6.3 MN with a mechanical arm and so on.

NC sheet-bending machines with a revolving bending beam for sheet measuring 3,200 X 4 mm and 4,000 X 3.5 mm; an NC hydraulic straightening press with a force of 0.4 MN; a set of equipment for the bending of shells on a three-roller machine for sheet measuring 10 X 2,000 mm with a loading table, a pusher and a roller table; a set of equipment based on a pipe-bending machine with power drive for pipe 100 X 3,000 mm in diameter with a loading device and other equipment are being developed for bending and straightening.

A crank and toggle coining press with a force of 16 MN with means of mechanization; a set of equipment based on a crank and toggle coining press with a force of 10 MN and an industrial robot with a lifting capacity of 10 kg and so on are being assimilated for cold die forging.

For hot die forging automated units for the stamping of forged pieces on hot-stamping crank presses with a force of 10, 16, 25 and 40 MN; horizontal forging machines with a force of 8 and 12.5 MN with the automatic feeding of the blanks; an automated unit based on a screw press with a force of 2.5 MN and an industrial robot with a lifting capacity of 10 kg and so on are at the stages of assimilation and production.

The range of automated equipment being assimilated, as is evident from the cited examples, encompasses primarily general-purpose and specialized traditional equipment with various means of mechanization and automation, which take into account the needs of the different conditions of press forging (with respect to the type of source material, series production and so on). Machines with program control and robotic units hold a significant place among the equipment being assimilated.

Among the indicated automated equipment, which ensures a significant increase of labor productivity, there are a large number of machines for obtaining precision blanks and introducing metal-saving technology. The special precision machine tools for cold ring rolling with a force of 0.25 and 0.63 MN; an automatic multi-position crank machine for cold extrusion with a force of 6.3 MN; an automatic multiposition hot-stamping nut machine, the diameter of the thread of an M27 nut; an NC radial reducing machine with a force of 1.6 MN with a loading and discharge device; an automatic press for finishing blanking with a force of 1.0 MN with a strip feeder; a set of equipment for the production of sleeves of long-stroke cylinders on the basis of a press with a variable load with a force of 12.5 MN and other equipment should also be assigned to this group of highly economical equipment. The degree of economy of the pressing equipment being assimilated for the compacting of powder materials and hard alloys; the automatic power machine for the compacting of items made from metallic powders with a force of 0.1 and 0.4 MN; the automatic power machine for the sizing of items of simple form made from metallic powders with a force of 1.6, 2.5 and 4.0 MN; the hydraulic press with a force of 1.6 MN for the production of plates, which cannot be turned on a lathe and are made from tungstenless materials; automatic hydraulic presses for the compacting of items made from the powders of hard alloys with a force of 0.25 and 0.63 MN; automatic power machines for the compacting of items made from the powders of hard alloys of different forces and others, is great.

In 1983 the assimilation of such heavy and single-design machines as the single-action four-crank closed spar press with a force of 63 MN; a hot-stamping power press with a force of 125 MN; a hydraulic press with a force of 100 MN for the stamping of the root of the tongue of switches and others is being continued.

A number of machines with increased productivity are being assimilated for the purpose of increasing the technical level, including such automatic machines as the automatic double-impact cold upsetter, the diameter of the spindle of the items of 2.5, 4, 6 and 8 mm; an automatic multiposition cold-stamping machine with devices for the facing of the workpiece, the removal of the chamfer and the thread rolling of the item with a diameter of the spindle of 22 mm; automatic multiposition cold-stamping nut machines for M12 and M16 nuts; automatic thread rolling machines with flat threading dies for a thread with a diameter of 6.8 and 10 mm; an automatic machine for the cold coiling of springs made from wire 4-10 mm in diameter; an automatic sheet stamping machine with bottom drive with a force of 0.63 MN with an unwinding device and a device for the removal of scraps; automatic hydraulic presses for the compacting of items made from metallic powders with a force of 1.6 and 4.0 MN and others.

A number of highly productive and efficient machines and sets are being assimilated and produced in conformity with the goal programs on the solution of scientific and technical problems.

Great tasks face the enterprises and organizations of the sector in the production and delivery of forging and pressing equipment to the Ministry of Tractor and Agricultural Machine Building, including for the enterprises involved in the production of Don grain harvesters and the motors for them.

The work on the implementation of comprehensive goal programs of the increase of the productivity and reliability and the decrease of the metal content of the equipment being produced should be continued.

The need for the systematic increase of the technical level and quality of equipment and the increase of the output of automated equipment, including highly productive equipment, NC equipment, units with robots, automatic lines and complete sets of equipment, are making greater and greater demands on the components. In this connection the press builders should formulate their own demands more clearly and persistently. We expect from the workers of related industries effective and prompt steps on the increase of the technical level and the development of the necessary electrical equipment, NC systems, instruments and so on.

Under these conditions the maintenance of the equipment at the consumer's is acquiring particular importance.

The installation of the equipment, its technological adjustment and placement into operation, the training of specialists, the monitoring of the operation of the equipment during the warranty period, the repair and modernization of equipment, the delivery of the necessary amount of spare parts in the shortest time--such are the basic types of operations, which should be offered by the maintenance services of the manufacturing enterprises to consumers, in the organization of which the manufacturers should regularly engage.

For the purpose of increasing the technical level and quality of the equipment being developed and shortening the designing time the enterprises and organizations of the Ministry of the Machine Tool and Tool Building Industry should develop and adopt automated designing systems in press forging machine building and ensure the fulfillment on the set date of the comprehensive plan of the development of automated designing systems in press forging machine building for 1982-1986.

The assignments for 1983 are intensive, but practicable and conform to the aims of the 26th CPSU Congress.

The honorable duty of the press builders is to mark 1983 with new advances in the development of domestic machine building and to ensure the further steady progress of our homeland toward communism.

7807
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UDC 621.8

USE OF MULTI-MACHINE TOOL SERVICE IN INDIVIDUAL PRODUCTION

Kiev TEKHNOLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 4, Apr-Jun 82 pp 6-7

[Article by Candidate of Economic Sciences A. F. Sinegub and engineers N. G. Timchenko, A. L. Yes'kov, N. I. Korsun and I. P. Ushakov of the "Novo-Kramatorskiy Machinebuilding Plant" production association of the Kramatorsk NIIPTmash (scientific Research and Technological Planning Institute of Machinebuilding): "Method of Using Multiple Machine Tool Servicing in Individual Production:]

[Text] Enterprises of the metallurgical machinebuilding subbranch have available to them a large stock of metal-cutting equipment, but the labor resources deficit creates a disproportion between the amount of installed equipment and the number of workers needed to service it. This causes considerable machine tool idle time and lowers the shift index and return on capital. Improvement in labor organization and, in particular, multiple machine tool servicing permit an increase in the effectiveness with which equipment is used.

Multiple machine tool servicing is currently understood to mean the operation of two, three or more machine tools by one operator. But under production conditions, situations can arise in which several units of equipment are serviced by a certain number of operators, generally fewer, that is, a man-machine system is created which is conventionally called a multiple machine tool complex. To create a multiple machine tool complex, we need to define its structure: type and amount of equipment and number of workers in the complex. In this regard, a worker's servicing several machine tools leads to unavoidable equipment idle time, depending on the number of operators. Given a number of workers close to the number of machine tools in the complex (as for example, a number of workers a total of one unit fewer than the number of machine tools), equipment idle time waiting for service will be inconsequential. And the reverse, increasing the difference between the number of machine tools and the number of workers leads to lower equipment use. In this connection, when determining the structure of the complex, the necessity arises of seeking among all the possible variants the one which will ensure its more effective operation under concrete production conditions. This question can be resolved using mathematical methods, in particular, queueing theory.

The operation of multiple machine tool complexes has been simulated in a mechanical assembly shop at the "Novo-Kramatorskiy Machinebuilding Plant" production association to assist in this planning. The unit-time structure of operations done on various machine tools was analyzed to evaluate the possibility of broadening service zones for large and medium-sized machine tools (using a classification adopted for calculating machine tool power).

We initially determined variants of probable multiple machine tool complexes consisting of large and medium-sized multipurpose equipment. Each complex was examined as a system whose component (equipment and operator) interactions were stochastic and irregular in nature and could be described by queueing theory methods. In this regard, a large number of technological operations of differing machine and auxiliary durations were performed on the machine tools in the course of a shift. The sequence in which the parts arrived at the machine tools and their combination were changed during the shift, also determining the irregular nature of the servicing process and worker movement to the machine tool.

It was established that the proportion of machine time at large and medium-sized multipurpose equipment was significantly higher than at small machine tools, 40--75 and 26-47 percent, respectively. This results from the engagement of workers up to 50 percent of the time at large equipment and the possibility of using machine operator machine time to service a second machine tool.

Output, as expressed in norm-hours (labor productivity), was adopted as the criterion of multiple machine tool complex operation effectiveness. Maximizing this indicator ensures an increase in output volume.

In multiple machine tool servicing, worker time expenditures on auxiliary types of work associated with worker movement from one machine tool to another, increasing amounts of moving blanks and machined parts, number of machine tool controls being operated and time actively spent observing the work are increased. Therefore, as a consequence of increasing worker engagement in the course of a shift, his maximum allowable engagement in basic equipment servicing functions is adopted as the basic limitation when choosing the multiple machine tool complex variant.

Queueing analysis requires the availability of statistical data on time periods between receipt of demand and time of service. Such data can be obtained from operational flow charts by representing the technological process of machining a part in the form of statistical series: auxiliary and machine time describing the length of time periods between receipt of demand and service, auxiliary time describing service duration.

Queueing theory analytical methods were used to process the statistical data, permitting determination of an aggregate of indicators describing the operation of each multiple machine tool complex variant: equipment idle time factor, machine tool operating machine time factor, worker engagement factor and others.

Multiple machine tool complex structure variants ensuring an optimum ratio of number of operators and amount of equipment in the complex were determined as a result of our analysis of possible machine tool consolidation variants using the chosen effectiveness criterion.

The total number of multiple machine tool complexes computed for the shop was 17. They consisted of 53 machine tools and 33 operators. The creation of this many multiple machine tool complexes and the possibility of redistributing the workers thus freed for other jobs permits improvement in equipment use: shift index increases from 1.4 to 1.85 and shop output increases by four percent.

Using the method described under individual production conditions can enable us to examine all possible machine tool consolidation variants and plan an optimum complex structure. Given collective forms of labor organization as have become widespread at metallurgical machinebuilding enterprises, this method can be used to determine the minimum multipurpose brigade size necessary for a shift or sector.

11052
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UDC 621.981.1.216.003.1

SHEET BENDING MACHINE WITH NC MODEL I3843P

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 5, May 82 pp 10-11

[Article by R.D. Lapsker and A.T. Lepilin]

[Text] ENIKMASh has developed a twin-roller sheet bending machine with numerical control, Model I3843P, for bending symmetrical sections into variously shaped parts according to a given program (Fig. 1): Parts with a constant radius of curvature (Type I); parts with sections having different radii of curvature, joined by plane sections between them (Type II); parts with variable radii of curvature without plane sections (the radius of curvature within each curved section is constant, Type III); parts with the radius of curvature varying continuously according to a given law along the length of the evolute (type IV).

The sections can be bent with the rib facing inwards (Fig. 2,a) or outwards (Fig. 2,b). The elastic coating is made of polyurethane grade SKU-PFL. Different sections are bent by mounting corresponding rollers.

Bending is achieved by embedding the smaller diameter upper rigid roller, 1, with the blank, 2, into the elastic coating, 3, of the lower roller of larger diameter and the displacement of the blank between the rollers. The degree of embedding is set according to the bending radius.

Two coordinates are programed: the degree of embedding of the rigid roller with the blank into the elastic coating and the displacement of the blank. Both coordinates can be controlled consecutively (position control) or simultaneously (contour control).

The numerical control system was developed by the Kharkov Scientific-Research Institute of Automated Control and Production on the basis of the serially manufactured NC type N33-2M.

The program parameters are computed analytically from the drawing of the part and recorded on punched tape. The program can be adjusted as required.

Technical Data

Maximum nominal moment of resistance of laterally bent section at σ_S = 250 MPa, mm	2,000
Maximum width of bent section, mm	80
Maximum rib height of bent section, mm	40
Roller diameter, mm:	
Upper	160
Lower, with elastic coating	400
Maximum velocity, m/min:	
Embedding of upper roller	0.5
Bending	12
Precision, mm:	
Embedding of upper roller	±0.05
Blank displacement	±0.5
Installed capacity, kW	8
Dimensions (without electrical and NC equipment cabinets), mm:	
Horizontal	1,080X1,420
Vertical	1,450
Weight (without electrical and NC equipment cabinets), kg	2,200

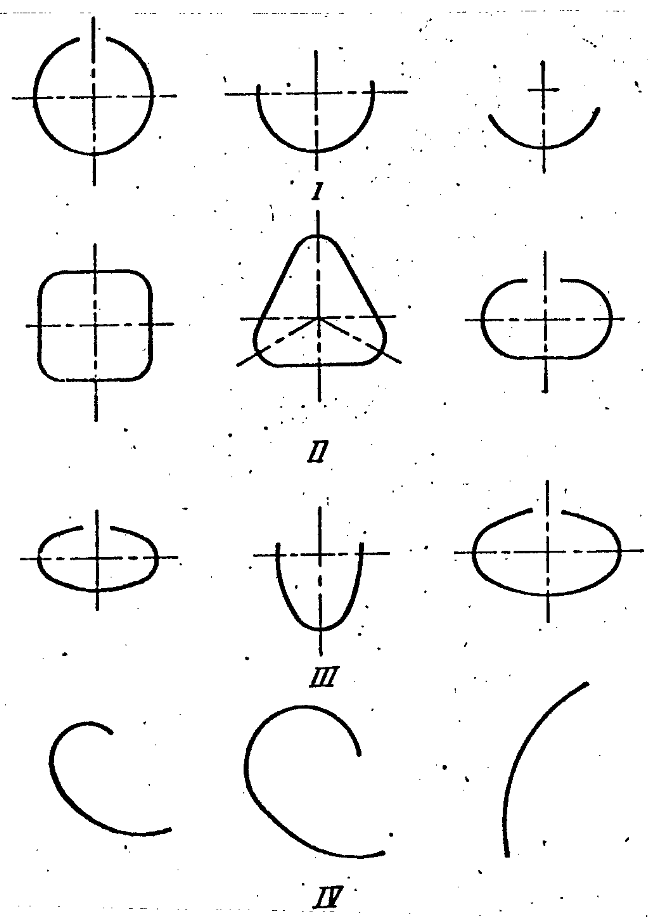

Fig. 1

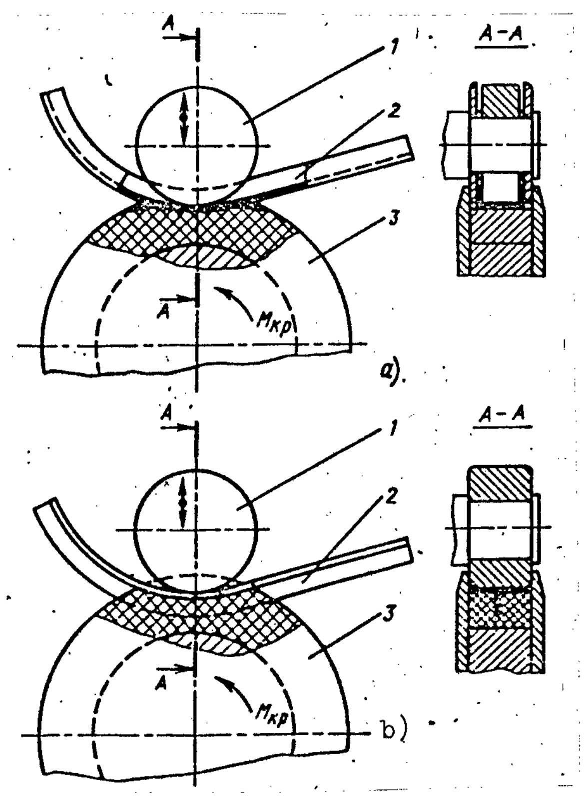

Fig. 2

The machine can produce a wide range of parts with minimal production costs, considerable reduction in machining attachments, and cash and materials savings in manufacturing the attachments. Labor productivity increases 1.2- to 1.5-fold, with better working and production conditions. Area needed to service the equipment and store attachments is saved.

The economic effect of the introduction of one machine at plants with small-series type of production, e.g., in aircraft construction or chemical machine-building, can be as high as 250,000 to 300,000 rubles.

Manufacturer: Voronezh Production Association for the Manufacture of Forging-and-Pressing Equipment imeni M.I. Kalinin.

9681
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UKRAINE USES UNIVERSAL ASSEMBLY MACHINES

Kiev TEKHNOLOGIYA I ORGANIZATSIYA PROIZVODSTVA. NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 3, Mar 82 pp 17-20

[Article by B. N. Kryzhanovskiy, candidate of Economic Sciences UkSSR SOPS [Council for the Study of Productive Forces] of the UkSSR Academy of Sciences: "The Effectiveness of Using UAM [Universal Assembly Machinery] in Machine Building in the UkSSR"]

[Text] The effectiveness of mechanical part machining depends to a significant degree on the extent to which production is supplied with technological equipment. Standard readjustable, reusable equipment, the most characteristic representative of which is the universal assembly machine (UAM), is one of the most effective types of equipment under conditions where many products are being produced with a frequent change of machinery being produced.

According to data from planning and design technical institutes, the use of UAM permits time periods for the designing and manufacture of devices to be reduced by 3-8 hours and the engineering necessary for production to be cut back by a factor of 2-2.5. The cycle of equipment assembly from UAM elements is 20-50 times shorter than the cycle for manufacture of special devices. It is known from domestic machine building practice that in order to manufacture 100 special machine tool devices in one month's time, one must have about 20 machine tools and 600 m^2 of production space, and 20 designers and 40-50 workers must be involved. Within the same time frame, 2 workers will be able to assemble this same number of devices from UAM components. For this, they need a complete UAM set of 600 components, a room with 40-80 m^2 floorspace and relatively simple equipment.

UAM systems have found the broadest application at enterprises and associations for chemical, heavy, transport and power machine building, the machine tool building industry, construction, road and municipal machine building and machine building for light and food industries and domestic appliances. According to calculations, more than 2.8 million UAM configurations have been assembled at the above-indicated ministries for the years 1971-1980; 7,791 workers were conditionally released, and the expenses, together with the cost of complete UAM units, was R9.2 million. The overall economic savings reached R25.8 million, and the cost recovery period was 0.36 years (with the norm being 8.3 years). The standard effect, calculated per unit configuration fluctuated between R8-10. The coefficient of cost effectiveness when UAM have been incorporated exceeds the normative value by a factor of 20 on the average.

UAM are being employed with particular success at many machine building plants in Kharkov, Kiev, Odessa, Lvov and Kramatorsk. For example, in the years 1976-1980, at the Kiev plant "Bol'shevik," approximately 15,000 configurations were being assembled annually with a savings of from R7,000-30,500 from reduction of production costs; at the Karkov Machine Tool Building Plant imeni S. V. Kosior--from 3,000-4,500 configurations (their recovery period was less than 1 year); at the Kharkov plant "Konditsioner" and the turbine plant imeni S. M. Kirov,--from 2,100-3,900 configurations, which permited from 12-47 workers to be released annually.

At the Odessa Heavy Crane-Building Plant imeni Yanvarskoye vostaniye, equipment design periods were reduced by 25 percent on the average due to standardization, while the manufacturing time in the machine shop was reduced by 10-12 percent. If the duration of the equipment designing cycle for production of a basic model of a parametric series is 6 months, it is only 1 month for the remaining models. The labor intensiveness of the design process are 21,000 and 3,500 norm-hours, respectively; labor intensiveness of manufacture are 88,000 and 5,500 norm-hours and the production costs of manufacture are R110,000 and 5,800.

In the PO [production association] "NKMZ" in 1980 (as compared with 1965), the number of UAM assemblies increased by a factor of 15, which permitted the labor intensiveness of mechanical assembly operations to be reduced by more than 11,000-120,000 norm-hours during the course of the year and provided a relative release of up to 30-40 primary and auxiliary production workers. In recent years at the PO "NKMZ" approximately 20,000-22,000 UAM configurations are assembled annually, providing an economic savings of R75,000-80,000.

The high effectiveness of incorporating readjustable universal assembly machines determines its promise in machine building. It is necessary to realize the reserves on hand to the fullest extent to improve the organization of mechanical milling production and to accelerate the application of progressive industrial processes.

First of all, the demand for UAM in machine building within the republic and the nation greatly exceeds the possibility for their centralized production at the "Soyuztekhosnastka" PTO [industrial engineering division, Kharkov and at the experimental facility of the Kramatorsk NIIPTmash [Scientific Research and Design-Engineering Institute of Machine Building]. As a result of this situation, UAM output is, as formerly, concentrated to a significant extent in tool shops where the level of production specialization is not high as a rule. It will take several years to manufacture a full set of UAM.

The advantages of assembled equipment systems are underrated at a number of enterprises. Even enterprises utilizing UAM do not always take into consideration the economies from their operation inasmuch as the engineering aspects of UAM have been worked out much more completely than the organizational and economic aspects.

In spite of the fact that a large number of enterprises and associations from various ministries and departments have not started production of UAM parts and assemblies and the fact that this output has been included in a national economic plan which must be fulfilled without fail, many of the tool shops of the machine building enterprises were unable to guarantee the required precision and quality, a fact resulting in inadequately high quality of entire UAM units.

The further development of centralized production of UAM components is necessary in the near future for the further development of UAM systems for machine building in the republic. In accordance with the approximate assessments of VNII Minstankoprom [All-union Scientific Research Institute of the Ministry of the Machine Tool Building Industry] as well as the predictions by the UkSSr SOPS of the UkSSR Academy of Sciences, the outlook is for the production volume of universal application assembly equipment to increase by a factor of 3.3 (from R12 million to R 40 million) at the Karkov Experimental Equipment Accessories Plant, whereas at the Nikolayevskiy Experimental Equipment Plant, it should increase by a factor of 12.5 (from R2 million to R 25 million) (with the condition that it be renovated and expanded). Moreover, new production facilities will be started up at the Bogodukhovskiy Equipment Accessories Plant which is now under construction. All of this will create the necessary technical and economic prerequisites for industrial enterprises to satisfy the demand for readjustable universal assembly machinery more completely.

It is also necessary to satisfy the increasing demand for UAM by expanding cooperation to involve tool shops from enterprises of interested ministries and also by specialization of production of individual, similar groups of UAM. In many sectors of machine building there are reserve capacities which can specialize in the production of parts with specific standardized dimensions and be included in unified cooperative production for delivery to a central site for subsequent assembly into sets and delivery to the plants, taking into consideration the specific requirements and orders of the various branches of machine building.

The question of worn part replacement also requires a solution. The parts of a set are designed for 12-15 years of operation. Consequently their annual wear is 7-8 percent of the unit, primarily the small parts. This fact makes systematic restoration necessary. Therefore, at plant UAM sectors it is necessary to set up mechanical departments with highly precise lathes and milling and grinding machines with which the plant units may be brought back to standard tolerances alongside the assembly and operation departments.

Along with centralization of UAM system manufacture, centralization of their operation represents a vast reserve for increasing their efficiency. The most efficient form for centralization of the operation of multiuse equipment is the UAM rolling facility. However, this progressive method of servicing UAM is not widespread at enterprises in the UkSSR at present.

As research has shown, it will be expedient in the future to organize a system of facilities for centralized operation of UAM within the republic to satisfy completely the demands for UAM within the republic's industry. This system will consist of 10 central rolling facilities with a capacity of up to 300,000 components each, 5 local rolling facilities with a capacity of up to 100,000 components each and 4 affiliate rolling facilities with a capacity of 25,000 components each. It is wise to deploy these facilities in regions with highly developed machine building. According to calculations the total volume of capital investment to establish these facilities will be R11 million (with the exception of costs for acquiring the UAM units). The period for cost recovery will be 2.2 years in all. The annual economic savings from operating the UAM systems acquired through the rolling facilities will be R 4.7 million. The average turnover rate for sets of UAM parts during the course of a year will increase by a factor of from 2.2 to 3.5, while the coefficient for its specific parts consumption will decrease by a factor of from 0.46 to 0.29. Moreover, at industrial enterprises using the services fo the UAM rolling facilities, the prerequisities will be established for release of a significant number of designers, manufacturing engineers and workers engaged in the design and manufacture of special equipment.

The efficiency of dismountable assembled readjustable equipment systems (a type of UAM) depends in many ways on coordination of the operations of the various organizations, scientific research institutes, ministries and departments, industrial enterprises and production associations which are engaged in the designing, technological development, manufacture and operation of UAM. Therefore it is advisable during the current five-year plan to compile a coordinating plan and an overall target program for incorporation of UAM. It is advisable to entrust management of these operations to Minstankoprom. Realization of such plans and programs will significantly increase the efficiency with which UAM are employed in machine building and metal working in the country and the republics.

9194
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USES OF NUMERICAL CONTROL IN PREVENTING BREAKDOWNS

Kiev TEKHNOLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 1, Jan-Mar 83 pp 4-6

[Article by B. A. Dmitrichenko, engineer: "Organization of Centralized Servicing of Machine Tools with ChPU [Numerical Programed Control]"]

[Text] In mechanized and automated production the efficiency level in using machine tools with ChPU depends greatly on the quality of the repair service which is called upon to keep the equipment in technical readiness at all times.

Experience in creating centralized servicing of an entire pool of machine tools with ChPU consisting of 80 units has acquitted itself well. One of the most important problems of the service is to reduce the number of failures and emergency stops of machine tools. The solution of this problem required the introduction of the organization of their technical servicing so that the basic efforts are directed toward preventing malfunctions. Continuous and strict monitoring of the frequency of planned preventive maintenance work was organized. The recommendations of manufacturing plants, as well as data from a number of plants on operating and repairing machine tools with ChPU were used.

Annual planning of technical servicing of machine tools using computers was put into effect. The program calls for the uniform distribution of repairs during the year according to their laboriousness. Monthly schedules are prepared for all types of repairs and technical servicing on the basis of the obtained annual schedule. On this basis, daily shift tasks are issued to repair mechanics. Completed repair work and its cost are monitored and taken into account by an especially appointed inspector.

Monthly preventive maintenance inspections and repairs are made systematically in order to maintain highly efficient management systems.

A check of the efficiency of management systems is made according to special test programs. Preventive maintenance work is done according to an annual schedule (broken down by months), in which preventive maintenance work is done on each type of machine tool with ChPU.

The preservation and life of machine tools with ChPU depend greatly on the organizing of a good lubrication and in keeping their hydraulic systems and liquids clean. Lubricating machine tools with ChPU, as well as the preventive maintenance of their hydraulic devices, are implemented in accordance with a schedule approved by the chief engineer. In this case, data of the analyses of the quality of the oil, made systematically by the chemical-technological laboratory of the enterprise, is utilized.

The volume and times for the indicated preventive maintenance work are monitored by a "Minsk-22" computer.

In creating a centralized service for machine tools with ChPU, great attention was also given to the organization of the accounting of idle time for technical reasons. Data recorded in operating logs during the month was processed on the computer which made it possible, besides a number of other rating indicators, to obtain a monthly coefficient of readiness for machine tools with ChPU for the enterprise as a whole.

The readiness coefficient (K_r) was calculated from formula:

$$K_r = \frac{\Phi - t_{рем}}{\Phi},$$

where Φ -- nominal operating hours of the machine tool during the investigated period, hours; t_{pem} -- total repair time of the machine tools during the investigated period, hours.

Statistical data for 3 years on monthly readiness coefficients, as well as on the amount of monthly preventive maintenance work made it possible to determine the effect of preventive maintenance work on the readiness coefficient of machine tools with ChPU. The statistical correlational analysis method was used to establish this relationship and the ensemble of points for this relationship was plotted accordingly.

Schedules were plotted on the basis of this data for normal two-dimensional statistical distributions which indicated that statistical distributions of the investigated values may be analyzed by the linear correlation method.

The degree of interrelation between the investigated values was determined by the correlation coefficient:

$$r = \frac{\sum K_r \ K_{np} - \frac{\sum K_r \sum K_{np}}{n}}{\sqrt{\left[\sum K_r^2 - \frac{(\sum K_r)^2}{n}\right]\left[\sum K_{np}^2 - \frac{(\sum K_{np})^2}{n}\right]}},$$

where K_{np} -- number of preventive maintenance measures; n -- number of investigated observation intervals.

It was established that the coefficient of dual correlation between the readiness coefficient and the number of preventive maintenance measures for ChPU systems is 0.905 (high degree of interrelation and relationship between investigated variables), while the coefficient of dual correlation between the readiness coefficient and the number of preventive maintenance measures for hydraulic systems and lubrication systems was 0.611 (average degree of interrelation and relationship between investigated values).

The values of the identified interrelations make it possible to use, for finding the relationship between them, linear regression equations of the type:

$$K_r = a + b\, K_{np}. \qquad (1)$$

Coefficients a and b are determined from equations:

$$a = \frac{\sum K_r \sum K_{np}^2 - \sum K_r\, K_{np} \sum K_{np}}{n \sum K_{np} - (\sum K_{np})^2};$$

$$b = \frac{n \sum K_r\, K_{np} - \sum K_{np} \sum K_r}{n \sum K_{np} - (\sum K_{np})^2}.$$

Substitution of statistical data made it possible to obtain the following equations:

$$K_r = 0.489 + 0.018\, N_{ChPU}, \qquad (2)$$

that characterizes the relationship between the readiness coefficient and the number of preventive maintenance measures taken for ChPU systems:

$$K_r = 0.6 + 0.028\, N_{hyd}, \qquad (3)$$

that characterizes the relationship between the readiness coefficient and the number of preventive maintenance measures taken for hydraulic and lubricating systems.

The mean square deviation in determining K_r in accordance with the equations found was calculated by formula:

$$\sigma = \sqrt{\frac{1}{n} \Sigma\, \delta^2},$$

where δ -- difference in the value of the actual K_r and that of K_r determined by the equation, %.

Substitution of data indicates that the mean square deviation in determining K by equation (2) is 11%, while by equation (3) -- 14%.

The presented relationships were obtained when operating 80 machine tools with centralized service consisting of 40 persons. They may vary by virtue of various objective circumstances -- change in the organization of the service work, an increase in the number of preventive maintenance measures, an increase in the reliability of new machine tool models with ChPU being placed in operation etc. The estimates obtained may be used at certain periods to plan measures to improve the organization of preventive maintenance work and to analyze the efficiency and quality of repairs at individual stages.

Thus, the introduction of centralized servicing of machine tools with ChPU made it possible to create an orderly system for planning and monitoring preventive maintenance measures to maintain the efficiency of an entire pool of machine tools with ChPU. The continuous accumulation and periodical processing of statistical data of the effect of preventive maintenance work on the reliability indicators of the operated machine tools with ChPU make it possible to create premises for developing a strictly substantiated methodology for planned preventive maintenance servicing of equipment with ChPU.

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AUTOMATED MACHINE FOR HORIZONTAL CONTINUOUS CASTING

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, Jan 83 pp 7-9

[Article by Doctor of Technical Sciences V. L. Ankhimyuk and engineer G. P. Komlik: "Automating Horizontal Continuous-Casting Machines"]

[Text] The simple design of horizontal continuous-casting machines (HCCM) predetermines their intensive use in nonferrous metallurgy and machinebuilding. An HCCM permits full mechanization and automation of the technological process, a reduction in operating expenditures and improved working conditions for servicing personnel.

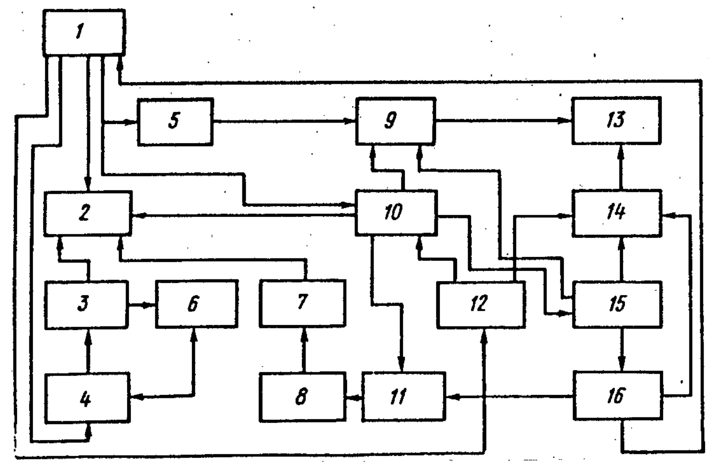
The HCCM is a complex machine with a large number of interconnected controlled, monitored and unmonitored inputs. For some inputs, the control can be effected with incomplete data and long delays. When setting up the control, consideration must be given to various technological limitations. Figure 1 shows a diagram of the links between production goals (increasing HCCM productivity, improving castings quality, increasing usable output, lowering operating expenditures), technological operations, performance and casting specifications. It permits systematization of data on changeable conditions, disturbances and the input and output values of the control object when automated. This information is presented in Figure 2 [both figures on following page].

The complex links among the physical properties of the metal, the characteristics of the casting-crystallizer system and the variable technological values and the absence of adequate a priori information on the laws by which crystallizer characteristics change require that elements of self-adjustment be introduced into the control system to obtain the desired work quality. With a view towards obtaining the lacking a priori information for optimum control, we simultaneously must study the operation of the object and control it. This information can be obtained by various methods, including the use of models.

Experience in operating HCCM's shows that the stability of the casting process is basically influenced by the temperature of the metal being poured, procedures for removing the casting and cooling the crystallizer. Deviations from these parameters lead to disruption of the technological process.

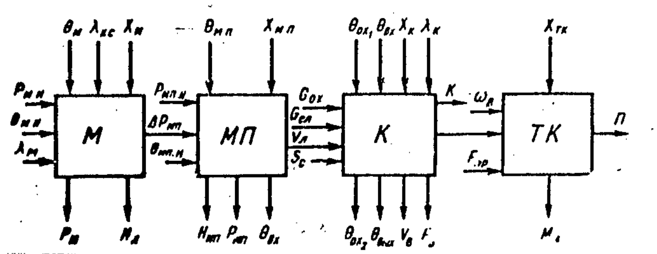
The following local technological parameter control systems are used for HCCM's: regulating liquid metal temperature (ordinarily, a thermocouple in a special

Figure 1. Internal Production Connections



Key:
1. HCCM control
2. HCCM productivity
3. Equipment reliability
4. Preventive routine maintenance
5. Thermal conditions of mixer and well
6. Operating expenditures
7. Usable output
8. Casting cutting
9. Internal structure
10. Casting speed
11. Length of cut casting
12. Crystallizer cooling conditions
13. Casting quality
14. Casting surface quality
15. Crystallizer thermal and power-plant conditions
16. Deviations in operation

Figure 2. Changeable Conditions, Disturbances, Input and Output Values of an HCCM When Automated



[Key to Figure 2 on following page.]

[Key to Figure 2, preceding page:]

Input values: $P_{мн}$ initial weight of molten metal in mixer,
$P_{мп.н}$ -- in well;

$\Delta P_{мп}$ influx of molten metal to well;

$\theta_{м н}$ initial temperature of molten metal in mixer,
$\theta_{мп.н}$ -- in well;

$G_{ох}$ water expenditure to cool crystallizer,
$G_{сл}$ metal expenditure,
$\lambda_{м}$ brand of alloy;

$V_{л}$ casting speed;

S_{c} casting cross-section;

$\omega_{в}$ draw roller speed of rotation;

$F_{пр}$ draw roller pressure force.

Variables: $P_{м}$ weight of molten metal in mixer,
$P_{мп}$ -- in well;

$H_{м}$ level of molten metal in mixer,
$H_{мн}$ -- in well;

$\theta_{вх}, \theta_{ох2}, \theta_{вых}$ temperature of molten metal at crystallizer entrance, cooling water and casting exiting from crystallizer, respectively;

$V_{в}$ casting removal speed;

$F_{в}$ casting removal resistance force;

$M_{в}$ moment of removal to draw rollers.

Disturbances: molten metal temperature - $\theta_{м}$ - in mixer,
$\theta_{мп}$ in well,
$\theta_{вх}$ at crystallizer entrance;

$\theta_{ох1}$ cooling water temperature at crystallizer entrance;

$X_{м}, X_{мп}, X_{к}, X_{тк}$ design parameters of mixer, well, crystallizer and draw stand, respectively;

$\lambda_{хс}$ chemical composition of molten metal in mixer;

$\lambda_{к}$ physicochemical properties of crystallizing metal.

Output Values: K casting quality;

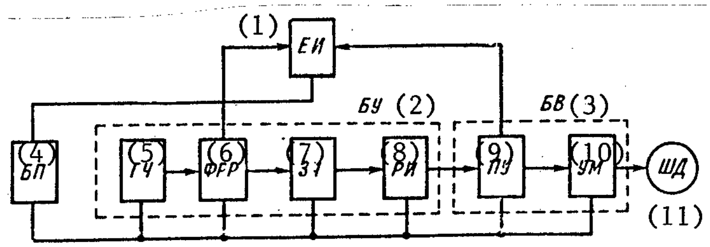
$П$ productivity of machine.

protective hood, connected to a temperature regulator controlling well heat); a temperature gradient control for water cooling the crystallizer (using a differential thermocouple) and water expenditure (measured by a float-type flow meter). Inasmuch as the casting speed regulation channel is the least inertial and permits rapid influence on the complex physical processes occurring in the crystallizer, let us examine the system for automating periodic removal of the casting from the crystallizer which is used on a majority of the HCCM's.

Both intermittently-operating (start-stop) drives and continuously-operating drives equipped with periodic-operation mechanisms (Maltese-cross intermittent transmissions, crank mechanisms with by-pass couplings, draw stands with various clamps) are used to remove castings.

The simplicity and the fast, precise operation of heavy-duty electric step motors (SM) make it possible to use them extensively in casting-removal drives. The drive is simplified and its reliability, adjustment and operating characteristics are improved. The technical parameters of the step electric drive permit meeting the demands of the technology and ensure casting with a small pitch and high frequency of castings removal. The Belorussian Order of Labor Red Banner Polytechnical Institute has developed a heavy-duty step electric drive with a series Sh-2.65 SM to obtain composition castings for the first time in domestic horizontal casting practice. The economic impact of its introduction has been upwards of 27,000 rubles per year. Even broader opportunities are opened up by the use of castings removal drives currently being introduced with series YeS heavy-duty step electric drives, a functional diagram of which is shown in Figure 3. The step electric drive permits obtaining high precision and a broad range of parameters in castings removal and an even, compact grain structure in blanks, as well as improving the quality and increasing the assortment of the products being released and improving machine productivity.

Figure 3. Functional Diagram of A Step Electric Drive for Removing Castings



Key:
1. [top] Display unit
2. [not in boxes, left] Control unit
3. [not in boxes, right] Energizing unit

[in boxes, left to right]

4. Power pack
5. Frequency generator
6. Operating conditions shaper
7. Frequency controller
8. Pulse distributor
9. Auxiliary amplifier
10. Power amplifier
11. Step motor

Since the values of a number of unregulated parameters of the casting process change in the course of that process, the task of optimal control of the latter is complex. The control system must therefore ensure effective monitoring of the process of shaping the casting with a view towards optimizing it and obtaining high-quality castings. A study of control objects has shown that this task is resolved most simply by changing the motor speed, and consequently the casting speed, as a function of thermophysical (casting cooling in the crystallizer) and power (interaction of casting and crystallizer and casting and other machine subassemblies) processes which determine the formation of the casting structure and surface. In this regard, the automated electric drive must regulate casting speed within a 1:20 range and change the rate of blank acceleration and retardation.

Thermophysical processes can be considered relative to casting surface temperature as it leaves the crystallizer. In this case, it is unnecessary to use a special crystallizer with a built-in heat sensor. Such crystallizers complicate operation of the machine and lower the reliability of the control system. It is preferable to use contactless thermal converters to monitor the temperature of the casting surface, as for example, the APIR-S radiation pyrometers and pyrometric converters complex, which is an aggregate of devices and apparatus combining pyrometric converters of the State Apparatus System into standardized parametric series.

The power processes are determinant in terms of their influence on casting stability and the quality of the blanks obtained. Experimental and theoretical research has been done on the power parameters for removing castings in order to calculate and set up an automated electric drive control system. This research has permitted development of an electric drive control algorighm ensuring casting with a small pitch and high frequency of casting removal, which is functionally linked to physical processes in the crystallizer. Miniature measuring pressure converters using the Hall effect were used to monitor the power processes. In view of operating experience, we need to improve their design for use under HCCM operating conditions.

11052
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AUTOMATIC LINES AND AGGREGATE MACHINING SYSTEMS

UDC 621.8

AUTOMATED PRODUCTION PROCESSES ABROAD DISCUSSED

Kiev TEKHNOLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 1, Jan-Mar 83 pp 18-20

[Article by M. K. Uskov, candidate technical sciences, K. V. Frolov, corresponding member USSR Academy of Sciences and P. I. Chinayev, doctor of technical sciences. Institute of Mechanical Engineering imeni A. A. Blagonravov USSR Academy of Sciences: "Development of Automated Productions Abroad."]

[Text] In industrially developed countries such as Japan, the United States, the FRG, Norway, the Netherlands, Sweden, Belgium and Great Britain, more and more attention is being given to the problem of automating small series and series production processes. Thus, in 1976, 25 comprehensively automated production processes functioned abroad, while at the start of 1980, their number increased to 54 in Western Europe and Japan. In Japan, at the end of 1978, there were 16 comprehensively automated production facilities and these increased to 26 by the start of 1980; in the FRG -- 4 and 8 respectively; in the United States -- 9 and 10 respectively; in Sweden -- 1 and 2 respectively.

In developing automated production processes in the very near future, the basic direction is the creation of automatic sections with the DNC [digital (?) numerical control] type control systems on the basis of multioperational and other machine tools with ChPU [Numerical Program Control] of the CNC [Computer numerical control] type. More and more frequently, the equipment of the automated sections includes machine tools with ChPU operating on "unattended" technology. The ASEA Firm (Sweden) published some data on the economic efficiency of operation of such a comprehensively automated section: the average daily norm of servicing is 3.6 machine tools per one operator; the average utilization coefficient of the machine tool equipment reached 0.93; the section pays for itself in 3.5 years.

A number of Japanese firms specializing in the area of machine tool building published data in their information materials on the creation of automated production processes with flexible control systems.

The most significant project at the development stage is "Comprehensive automation of production processes using lasers." The project is being implemented in Japan financed by the government. Some 20 large firms participate in its implementation. Some 80 million yen were spent from 1973 to 1976 inclusive and over 4 billion yen -- from 1977 to 1980 inclusive. The cost of the entire project is estimated at 13 billion yen (30 million rubles), the proposed completion date is 1983-1984 and it is planned to have operating facilities in 1990.

The project envisions the automation of design work, work on technological preparation for automating storing operations, machining and assembling machine tool units (gear boxes; spindle units; pumps etc.) weighing up to 500 kg with linear dimensions of up to 21 meters for small series production. It is planned to change the technology by the wide use of technological lasers when producing intermediate products, machining and monitoring parts.

In 1981, the "Fujitsu Fanuk" Firm (Japan) began large series production of metal-cutting machine tools and industrial robots with programed control.

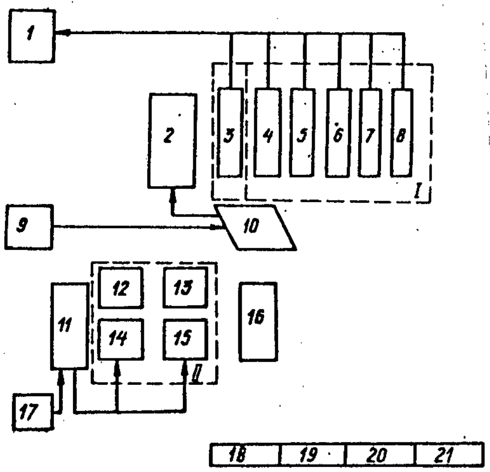
The production of metal-cutting machine tools and industrial robots is concentrated at the "Fun Factory" (see Fig.). At present, it has about 70 workers and employees. The plant manufactures models 0, 1 and 3 industrial robots, models E, H and T machine tools for electric pulse machining with ChPU and a model C machine tool with ChPU. The plant capacity is up to 100 machine tools and 100 robots per month.

The single production building with a total area of 20,000 m^2 contains a shop (area of 18,000 m^2, 10 meters high) and work rooms. The transportation and warehousing of intermediate products, materials and finished products are automated and are done by industrial robots and conveyor systems.

The machining lines consist of robotized modules, including machine tools with ChPU, equipped with monitoring devices. On these lines there operate 20 machine tools with ChPU, 5 processing centers, and turning and grinding machine tools, including a model IR500 MF4 machine tool made by the USSR. One worker services 3 - 4 machine tools on the average. When intermediate products are available the machining section continues operations during the night shift without operators. The shop is not heated at night, while in the daytime, it is heated by solar batteries mounted on the roof of the building. The savings from using solar batteries is 7500 yen per year.

Many firms are improving the readjustable sections at their plants all along, accumulating the experience of raising their reliability, as well as the adaptation and the design standards of the machine tools and automation facilities, and determine the optimal volume of the series output (taking into account the laboriousness of machining selected parts and the economic effectiveness). Sets of parts that ease the solution of the problem of comprehensive automation are selected for these production facilities.

The new principle of designing an automated production section was proposed in 1977 by the Japanese firm "Yamasaki machinery Yorke." In the creation of the system, an attempt was made to eliminate certain shortcomings inherent in multioperational machine tools. In the process of solving this problem,



Arrangement of a production building of a plant:

I -- assembly section;
II -- machining section;
1 -- finished product warehouse;
2 -- automated warehouse of complementing products;
3 -- robot assembly line;
4 -- drilling machine tools assembly line;
5 -- horizontal processing center
6 and 7 -- assembly line for electric impulse machining machine tools
8 -- turning machine tool assembly line;
9 -- place for arrival of complementing parts;
10 -- section for acceptance and inspection of complementing products and parts;
11 -- automated warehouse for intermediate products;
12 and 13 -- machining line (mounting and fastening intermediate products with aid of robots;
14 and 15 -- machining line (mounting and fastening intermediate products manually;
16 -- automatic welding section;
17 -- place for arrival of intermediate products;
18 -- central monitoring system;
19 -- central control system;
20 -- technical training center;
21 -- demonstration hall.

it was proposed to divide multioperational machine tools into their component units and thus provide the possibility of changing their mutual disposition. The unit-block design of the machine tools made it possible to combine units in accordance with the program.

In 1971, in Great Britain, leading specialists of the International Institute of Machinebuilding Technology developed a forecast (from 1978 to 2002 inclusive) on the basis of the Delphi method of expert estimates for production automation. This forecast envisages displacement of the usual machine tools with ChPU and designs of automatic plants. It is assumed that by 1987, machine tools with ChPU will be 50% of the pool and 75% by 2000.

A number of universities (Michigan, Tokyo etc.) are studying the prospects of developing the comprehensive automation of small series production and developing plans for the complete automation of large plants, including the automation of production control and assembly of products, delivery of tools from warehouses, adaptation of machine tools to change in machining conditions, diagnostics etc.

The study of this experience is of interest to domestic machinebuilding.

2291
CSO: 1823/40

ROBOTICS CONFERENCE HIGHLIGHTED

Minsk SOVETSKAYA BELORUSSIYA in Russian 25 Jan 83 p 1

[Article by BELTA correspondent V. Sivakov: "A Robot at the Entrance Gate" From the Minsk Municipal Practical Scientific Conference "The Use of Robot Technology and Manipulators Is an Important Factor for Increasing Production Efficiency"]

[Text] In the lobby of the social-cultural complex of the Minsk plant "Termoplast" where the conference was going on, I met an old acquaintance, the "Kontur-002" robot. At one representative Moscow exhibition, this citizen of Minsk impressed people with his remarkable abilities. Our fellow countryman had not lost them even now. Having turned on the tumbler switch, when I depicted an intricate pattern with his "hand," he then independently repeated all the movements exactly. He remembered and repeated instantaneously.

And now (don't be stingy, it's fantasy!) let's imagine in his hand a paint brush, a cutting tool, a welding electrode, a file...The list of possibilities for "Kontur" extends its technical data sheet: the robot is intended for the application of coverings through the method of pneumoatomization, electrodeposition, immersion, executing shotblasting and sandblasting operations, and the loading and unloading of parts; it can be used in all branches of the national economy. Today production greatly needs electronic assistants. In fact, for a while in Belorussia more than 30 percent of basic workers were engaged in manual labor, two-thirds of auxiliary operations are conducted manually, and thousands of work places (75,000 in Minsk alone) do not require higher qualifications from people, and they are noted for the monotony of the job.

Moreover, we know that tomorrow already every pair of working hands will be worth their weight in gold. Let's assume if in the 9th Five-Year Plan the increase of labor resources in the republic totaled 500,000 persons, then in the current one, according to forecasts, it will **decrease five-fold,** and in the 12th Five-Year Plan **even** more. In other words, tomorrow we will not be able to manage at all without labor-saving technology. Here everything is reckoned upon "the actually revolutionary possibilities..of industrial robots," as it was noted at the 26th CPSU Congress.

The calculation is based on this very same "Kontur." But until he is a worker, he is just a mannequin in a white dickey. They say it's true that he began a job as a painter on a conveyor at one of the Leningrad enterprises. In this very capacity he will also appear soon in an industrial association for computer technology. They are getting ready to use him, a robot of the intellectual category, even for sanding boats.

This is to say, it will not become a matter for executive organs and their attachments. The problem, as emphasized at the conference, is elsewhere: The level of today's production forges the possibilities of current developments. For the time being we have a few easily resetable automated workshops and sections connected directly with the whole factory control computer system and wherever technological robot modules served the core of the business. "It is necessary to solve the problem of creating flexible automated production," first deputy minister of the USSR radio industry A.A. Reut told the BELTA [Belorussian News Agency] correspondent. "It is necessary to solve these tasks simultaneously--the preparation of a programmed guarantee, an improvement of tool organization and the suitability for industrial production of goods, and the creation of modules with a complete cycle of operations. It is necessary to work at it and it is a worthy cause."

The citizens of Minsk have very good groundwork. A heavy machine-building base and large enterprises for the production of computer equipment are here, and there are interesting developments of the Cybernetics Institute of Belorussian SSR Academy of Sciences regarding the automation of planning for design and technological training. In the city there are many branch institutes and KB [design bureaus] which are developing modules and control systems. Programs for the introduction of robot technology are prepared at the enterprises. But the work is expected to be very complex as Anatoliy Antonovich summed up. They will not manage without the assistance of the union and republic ministries. It is necessary for branch institutes and specialists on the scientific organization of labor to engage more broadly in the robotization of production. Uniting the efforts of all interested parties will ensure the creation of automated sections and workshops as early as the 11th Five-Year Plan.

"Mutual interest--now that's what we really don't have enough of. And sluggishness, passivity, the backwardness of some managers, and a political underestimation of the problem" first secretary of the party gorkom G.G. Bartoshevich emphasized in his report at the conference, "do not simply hamper the matter, but even lead to hasty and false conclusions concerning the low efficiency of robot technology and discredit the idea itself of robotization. Through this reason alone it is possible to explain the fact that only two dozen of the capital's industrial enterprises and associations out of 150 actively joined in the work."

You won't get far on an old cart. This is already an axiom. It was not by chance that the city party committee, having studied the requirements of enterprises in advanced technology with the assistance of scientists and specialists, proposed a promising program to the conference participants for using robot technology. For the five-year plan it projected the introduction of not less than 2,000 robots which exceeds fourfold the planned target of the

Belorussian Communist Party Central Committee. According to calculations, the program will yield an economizing effect of more than 7 million rubles; will make it possible to double the shift schedule and the use of production-process equipment and labor output two to threefold; and will release 3,000 workers.

Fifteen years ago there was essentially not one automatic machine at "Termoplast." But today the plant is entrusted with conducting a conference on robot technology which it managed brilliantly. Yesterday's novice has become one of the leaders. It's not any phenomenon, but simply the solid enthusiasm and steadfast nature of the plant specialists. Today they themselves are already developing, creating and introducing robot technology in their workshops.

"We have it set up like that," deputy chief plant engineer I.M. Pavlovich told me. "If our experience is needed, come to the plant. We will demonstrate everything, explain, and listen. If our assistance is actually necessary to the outside, we will provide our visitors with drawings and a detailed consultation. It would be a benefit to our work!"

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COORDINATION OF WORK ON AUTOMATED MANIPULATORS DESCRIBED

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, Jan 83 pp 14-15

[Article by Candidate of Technical Sciences V. M. Guslits: "Coordinating Work On Developing and Introducing Automatic Manipulators"]

[Text] The article published by Candidate of Technical Sciences V. P. Bobrov a year ago ("Conditions For Introducing Automatic Manipulators In Machinebuilding," MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA, No 4, 1981) on introducing automatic manipulators (AM) reflected the concern in the engineering-technical community at the absence of principles for defining efficient areas of application for these mechanisms. The article proposed an AM definition and classification, and far-reaching conclusions were drawn from these proposals. We do not want to sort through here what we consider to be the false theses of that article, as various authors have said quite a bit about them in this journal in the intervening period. We shall focus attention only on the conditions which could have been misleading.

As is known, the unity of terms and definitions, classification, specifications and methods of evaluating the technical level and quality of equipment must be supported by appropriate standards. The paradox in this instance is that, although AM's are being widely introduced in various branches of industry, no such basic standards have yet been developed. The existing GOST 21024-75, "Manipulators. Terms and Definitions," does not reflect the current status of AM development, since it concerns master-slave manipulators, which were what had been developed when the standard was created (1975).

Branch programs for introducing AM's this five-year period anticipate both manufacturing for appropriate needs and deliveries from other machinebuilding branches. Under these conditions, the absence of unified terminology, specifications and methods of evaluating AM's is a serious brake on implementation of the planned programs and complicates enterprise relationships both at the interbranch level and also within branches. The indicated unsolved problems constantly complicate the organization and methods supervision of the creation and introduction of AM's at tractor and agricultural machinebuilding plants.

In connection with the inadequate development interbranch cooperation on introducing AM's, attention should also be paid to what we feel is the most important task of information support for AM development and introduction. We need a choice of nearest analogs in AM developments to evaluate their technical level and quality. This choice must be made using a generally accepted and identically understood list of standard parameters and characteristics from an interbranch analog data bank.

Data banks are currently being created in the branches in one form or another. However, the data in them do not follow a unified list of characteristics, but are provided most fully only for the AM models being developed in the given branch, while information on models from other branches is generally by no means as complete as is required, often forcing additional research testing of series-produced models. All the above relates to data on auxiliary (AE) and technological (TE) equipment, along with the AM making up automated technological complexes (ATC). The random, uncoordinated development of branch data banks does not enable them to be used with greatest effectiveness. This is due to the differing levels of data processing, storage and operational use, often without using known machine methods.

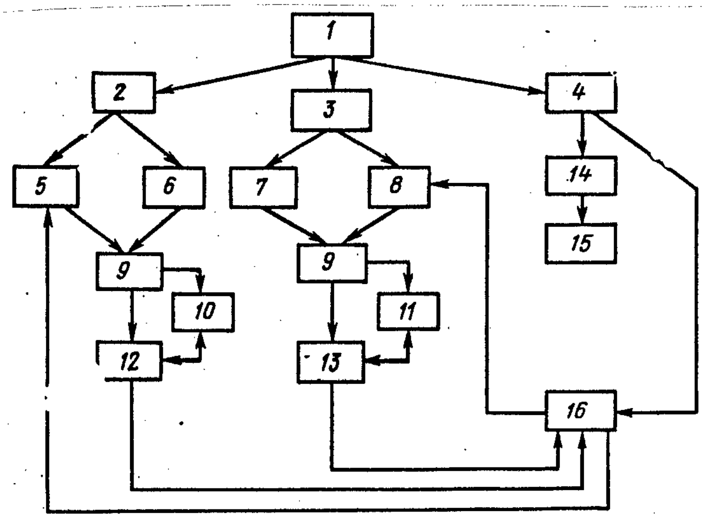
Opportunities for analysis appear in the course of developing an interbranch data bank, with the possibility of revealing standard resolutions permitting substantiation of the necessity for series manufacturing both AM models and individual AM subassemblies, with appropriate additional development of components for unitization or modularization.

In addition to offering a choice of analogs when developing AM's, AE and TE, the interbranch data bank will permit the best choice of models of this equipment best suited in terms of specifications for a specific instance of AM introduction, that is, for a certain ATC being developed. In this regard, the choice can be made with consideration of such additional characteristics as opportunities for making deliveries within certain schedules and in the amounts required, and so forth, as well as resolving the tasks of optimizing the choice of ATC equipment given competing requirements.

The development of an interbranch data bank is especially important in substantiating the characteristics and composition of series-produced ATC's and in eliminating duplication of effort in developing ATC's. The difficulty in recording all the diverse conditions of AM application currently leads to the manufacture of ATC's comprised of AM's with either excess or inadequate capacity. In the first instance, funds are frozen and there is an overexpenditure of labor and materials, and in the second, the consumer is forced to break up the ATC and create an essentially new complex in its place. Even if the ATC being developed is intentionally unique, use of an ATC data bank can greatly reduce the amount of planning work through the use of partial resolutions from previously developed ATC's using their individual criteria as reflected when classifying them. The work described on developing an interbranch data bank on AM's and other equipment comprising ATC's, as well as the ATC's themselves, is reflected in the functional diagram on the following page.

The USSR State Committee for Science and Technology should probably, we are convinced, assume organization and methods leadership of this work.

Proposed Diagram for Creating an Automatic Manipulators Data Bank



Key:

1. Lead development and introduction organization
2. Collection and processing of data on AM, AE and TE models
3. Collection and processing of data on AM introduction in ATC's
4. Methods work
5. Calculated and experimental determinations under laboratory and production conditions
6. Collection of data on published materials
7. Collection of data on proposed sites for introduction
8. Collection of data on branch introduction
9. Classification and codification in the branches
10. Revealing components subject to unitization
11. Revealing standard introduction instances
12. Storage and use of data on AM's, AE and TE
13. Storage and use of data on ATC's
14. Development of classification and methods of processing and using data on AM's, AE, TE and ATC's and coordinating them among the branches
15. Development of recommendations on data codification, use and storage
16. Organizing exchange of data among the branches.

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